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FRANCIS H. SNOW'S NEW MEXICO BUTTERFLY COLLECTIONS

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ABSTRACT. Francis H. Snow laid the foundation for scientific butterfly study in New Mexico. From his faculty post at the University of Kansas he led six natural history collecting expeditions into New Mexico between 1880 and 1894. These campaigns produced one butterfly species new to science, more than 90 state records, useful summary reports and labeled reference specimens. Butterflies collected on his first and last New Mexico expeditions are published here for the first time. Eighty labeled specimens from these six expeditions remain in the collections at the Snow Entomological Museum at the University of Kansas.

Additional key words: naturalist, natural history, collecting expedition, entomologist.

There was little systematic Lepidoptera study in New Mexico before the expeditions of entomologist Francis Huntington Snow. With so little known about its insect fauna, New Mexico must have seemed to Snow like an ideal destination. He was the first to conduct extensive butterfly collecting in New Mexico, the first to document detailed results in published reports, and the first to adequately label New Mexico specimens for future use. Snow's New Mexico contributions were first documented in published reports listing butterflies collected on expeditions in 1881, 1882 (Snow 1883), 1883 and 1884 (Snow 1885), which stood unquestioned for nearly 100 years.

It was the late 20th century before knowledge of the New Mexico butterfly fauna advanced to the point where some of Snow's published reports could be critically examined. In 1978, M. Toliver sought to confirm or refute certain inconsistencies by examining specimens in the collections at the Snow Entomological Museum (SEM) at the University of Kansas (UK). Toliver's determinations of dubious Snow reports helped consolidate historic knowledge of New Mexico and Rocky Mountain butterflies (Ferris & Brown 1980, Cary & Holland 1994, Toliver et al. 1994).

Snow published collection reports for New Mexico expeditions from 1881 through 1884 (Snow 1883, 1885). Snow (1883) briefly mentioned an 1880 New Mexico expedition, but implied that it produced no butterflies. He also mounted an expedition to New Mexico in 1894, for which he published Coleoptera collections (Snow 1907) but not Lepidoptera. Review of biographical material and re-examination of SEM collections in 1998, 2000 and 2002 confirmed that Snow collected butterflies in New Mexico in 1880 and 1894 and revealed details about those expeditions. Research also showed that Snow's expeditions of 1881 through 1884 produced more species than indicated in his reports. Previously unreported collections are described below.

In this project, the authors profited from several sources of biographical information. Snow's biographer (Hyder 1953) listed all of Snow's scientific expeditions including his 1880 trip to Santa Fe Canyon and the 1894 trip to the Magdalena Mountains. Following Snow's death in 1908, Snow's colleagues eulogized him as a teacher, scientist and collector. Miller (1909), Marvin (1909), Stevens (1909) and Dyche (1909) provided valuable information and insights into Snow's character and methods. Snow belatedly published combined Coleoptera results from his six New Mexico collecting expeditions (Snow 1907). It is worthwhile now to do the same for his butterflies.

Francis Huntington Snow

Born in 1840 in Fitchburg, Massachusetts, Francis H. Snow was raised with a strong work ethic and religious faith. His father was a staunch abolitionist who gave haven to escaped slaves on the Underground Railroad. Snow matured as the nation considered statehood for Missouri and Kansas; the Snows worked to keep Kansas slave-free. Snow was valedictorian of the Williams College class of 1862. Toward the end of the Civil War, he provided spiritual and hospital services for sick, wounded and dying soldiers.

Snow was classically trained and socially motivated, a practiced preacher and gifted educator. In 1866, five years after Kansas was admitted to the Union as a free state, Snow accepted a position with the newly founded University of Kansas in Lawrence. As one of the first three faculty members, he helped recruit students and assemble buildings, faculty and curricula. In 1868 Snow returned to Massachusetts, married Jane Aiken and brought her to Lawrence. He was devoted to his family, which eventually included six children.

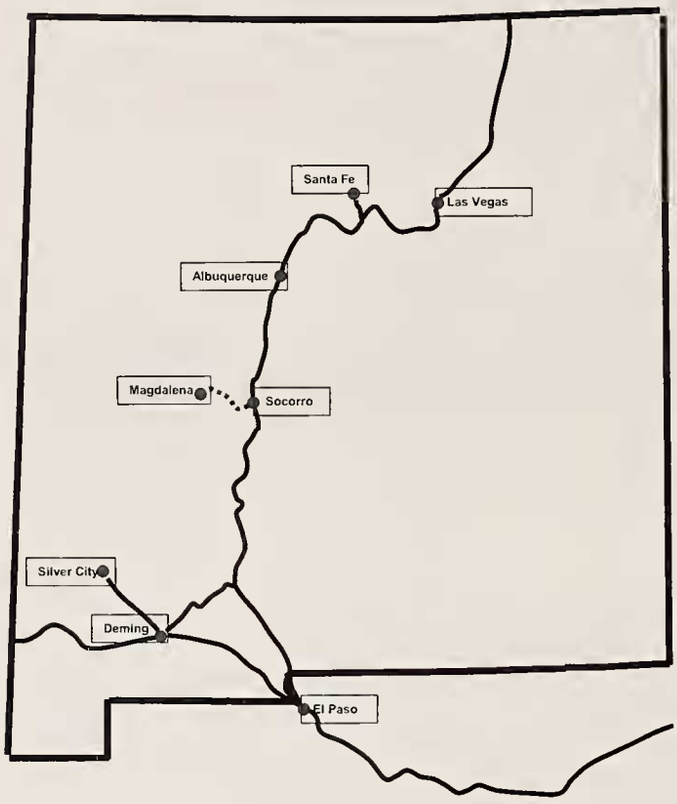

FIG. 1. Snow's New Mexico expedition locations and railroad lines ca. 1890.

Most of Snow's collecting excursions were family affairs and he corresponded with his wife when circumstances prevented her participation.

Snow taught every branch of natural science at UK. He had to teach himself first because his classical education did not include the many new scientific subjects. During his career Snow published more than 150 papers and reports. In 1890 Snow was named Chancellor of the UK. He served until 1901 when the strain of work and the untimely death of his first son forced him to cut back. Snow found solace and strength in the outdoors and, until his death in 1908, Snow did what he loved best—collecting, working with specimens, and teaching students about nature.

Collecting Expeditions

During his 42 years at UK, Snow lead 26 collecting expeditions to Kansas, Colorado, Texas, New Mexico and Arizona (Hyder 1953:279–280). For these expeditions, Snow sought out regions that offered opportunities for naturalists to discover and study new flora and fauna. Dyche (1909:40) explained that Snow's primary objective during these expeditions was "to make collections of insects, although he was interested in nearly every branch of natural history, and encouraged his assistants and students to collect birds, mammals, reptiles, fishes and plants, as well as specimens of rocks, minerals and fossils."

Each expedition produced thousands of specimens (Miller 1909:24), which Snow examined upon his return. Varieties not represented in the UK collection were sent to specialists for determination. Specimens that enhanced the breadth of the UK collection ultimately were retained, but thousands of others ended up in the duplicate collection. Snow treated duplicates as assets to be sold or traded with collectors in the U.S. and Europe in return for other desirable specimens (Dyche 1909:44). Although his expeditions produced hundreds of insect species that were new to science, it appears that Snow himself described none (Dyche 1909:44).

1880: Santa Fe Canyon, Sangre de Cristo Mountains

The 1880 UK expedition came by railroad (Fig. 1) to Santa Fe, the capital of New Mexico Territory (Snow 1881b). Snow brought his family (Jane, 11-year old son Willie and 10-year old daughter Mattie) and two student assistants, Louis L. Dyche and Annie E. Mozley. The group was in the field from August 6 to September 3. From their camp in the canyon of the Santa Fe River, they collected in the southwestern part of the Sangre de Cristo Mountains in Santa Fe County.

Confusion clouded the correct location of Snow's 1880 base camp. Snow first described it as "in Santa Fe canon" "eight miles from the city of Santa Fe, at an elevation of 7,000 feet" (Snow 1881b:67), then later as "eight miles north of Santa Fe" (1907:165). Dyche (1909:42) stated it most clearly: "Camp was located eight miles up the cañon from Santa Fé." Starting from the City at 7000 feet elevation on the Santa Fe River, eight miles up-canyon took Snow eastward to about 8000 feet elevation.

Arriving in Santa Fe in 1880, Snow found a landscape occupied by Spanish colonists almost continuously since ca. 1700. He traveled up the Santa Fe River along a well-worn trail first used by Indians, then by European settlers driving livestock to summer pasture (Fauntleroy 1999). Arrival of the transcontinental railroad in 1880 opened Santa Fe to nationwide economic markets, prompting local farmers to expand their herds. One year later near Snow's camp, the City constructed McClure Reservoir, which still remains part of the City's public water supply system (Fauntleroy 1999).

The published report for the 1880 expedition listed 273 species of Coleoptera, but no Lepidoptera (Snow 1881b). Instead, Snow remarked on the "conspicuous scarcity in Santa Fe canon . . . of the Lepidoptera, both diurnal and nocturnal," which he attributed to "nu-

TABLE 1. Butterflies collected during Snow's 1880 expedition to Santa Fe Canyon, Santa Fe County, New Mexico. SEM = Snow Entomological Museum at the University of Kansas.

Taxon	Number of SEM specimens	Importance
Erynnis pacuvius (Lintner, 1878)	1	
Apodemia nais (W. H. Edwards, 1876)	1	1st NM specimen
Speyeria hesperis (W. H. Edwards, 1864)	2	1st NM specimens

merous flocks of sheep and goats, which destroy the food plants of these insects" (Snow 1881b:68).

Toliver's 1978 review of SEM specimens revealed the first butterflies from this expedition (Table 1). He found two specimens of *Speyeria hesperis* (W. H. Edwards) and one of *Erynnis pacuvius* (Lintner) labeled from Santa Fe Canyon in August 1880. The senior author discovered a similar specimen of *Apodemia nais* (W. H. Edwards) while researching collections of the National Museum of Natural History (NMNH) in the 1980s. Recent review of the SEM collection revealed a second *A. nais* specimen with the 1880 label. Each specimen from this expedition is recognized by a typeset label reading "S. Fe Canon, N. M., 7000 ft., Aug., 1880 (Snow)."

1881: Water Canyon, Magdalena Mountains

Snow returned to New Mexico in August 1881. Prompted, perhaps, by the previous year's disappointment, he ventured farther from civilization into wilder country, to Water Canyon in the northeast part of the Magdalena Mountains, Socorro County (Fig. 1). Snow's 1881 crew included son Willie, Mr. Dyche and physics professor H. S. S. Smith.

As with much of south-central New Mexico at that time, the original Apache inhabitants still clung tenaciously to their lands, which included the Magdalena Mountains. The prospect of travel there may have given the Snow household reason for pause. This expedition began routinely, as Snow wrote to Jane on August 11: " . . . I was never before so far away from the railroad in camping out. We are 25 miles west of Socorro, New Mexico, so that it is entirely out of the question for any of us to go to town as we did at Santa Fe . . . Our camp is about 2 miles from the entrance to the cañon, near the log house of one John Smith who has lived here 8 years, during which time not a single Indian has entered the cañon . . . Willie is having a fine time and says he is glad he did not stay East. We both, however, miss you and the little girls sorely. . . Willie and I are getting lots of fine butterflies & other insects & Dyche is putting up plants of which there are many new and beautiful species."

Two days later, Snow's idyll was shattered when a messenger, "who showed a bullet hole in his hat," informed the group that the local Apaches had become hostile. Snow's group assembled at a cabin with some miners and kept watch for three days (Hyder 1953:158–159). The group then headed for the safety of Socorro on a journey described by Snow: "We were asked to leave all our belongings in order to go down the cañon double-quick, but I could not see how a dozen or so of light cigar boxes filled with my bugs could endanger our march, so despite the wishes of the others I carried with me thirteen boxes of my bravest [finest] insects. I tied them up so I could get my arms around them and, putting my Boston Winchester over my shoulder, and with little Will, my boy, clinging to my sleeve, we started for Socorro . . . On the way down we found pools of blood where men had been murdered, and their wagons looted. Our teamster was one of the victims. A posse of 100 men coming out from Socorro met us and with them we continued our march down the cañon."

The 1881 expedition retreated to areas that were safer, but less desirable for collecting. They spent three weeks near Socorro, one day at Deming and a week near Pecos (Dyche 1909:42). Snow (1883:36) referred his specimens to W. H. Edwards for determination. This troubled expedition produced more than two dozen species of butterflies from Water Canyon (Table 2) and one from Deming, but none from Socorro or Pecos (Snow 1883). Each Water Canyon specimen in the SEM was identified based on a single typeset label stating: "Water Canon, N. M., 5000 ft., Aug. '81, F. H. Snow."

1881 is the first year for which Snow's reports can be compared against extant specimens. Allowing for nomenclature changes, they match pretty well. The few discrepancies are understandable after more than a century of taxonomic progress. Snow's report of *E. funeralis* (Scudder & Burgess) probably was the similar *Erynnis tristis tatius* (W. H. Edwards), which was not described until 1882 (Ferris & Miller 1980:21) but for which there is an 1881 SEM specimen. He also reported *Erynnis martialis* (Scudder), which is impossible (see Cary & Holland 1992[1994]). He probably had *E. afranius* (Lintner) based on size, markings, habitat and voltinism, but this remains speculation until a specimen is located. The final 1881 mystery concerns *Brephidium exile* (Boisduval). Snow (1883) reported it only from Deming, but the 1881 SEM specimen has a Water Canyon label.

Snow's labeled elevation represented the mouth of

TABLE 2. Butterflies collected during Snow's 1881 expedition to Water Canyon, Magdalena Mountains, Socorro County, New Mexico.

Taxon	Reported by Snow (1883) as	Number of SEM[1] specimens	Importance
Erynnis pacuvius (Lintner, 1878)	Thanaos Pacuvius *Lintn.*		
Erynnis tristis (Boisduval, 1852)			
ssp. *tatius* (W. H. Edwards, 1882)	Thanaos funeralis *Scud.-B.*	1	1st NM specimen
?*Erynnis afranius* (Lintner, 1878)	Thanaos Martialis *Scud.*		1st NM report
Pholisora catullus (Fabricius, 1793)	Pholisora catullus *Cram.*		1st NM report
Piruna pirus (W. H. Edwards, 1878)	Pholisora Pirus *Edw.*	1	1st NM specimen
Pterourus multicaudatus (W.F. Kirby, 1884)	Papilio Daunus *Edw.*		1st NM report
Pterourus rutulus (Lucas, 1852)	Papilio Rutulus *Bd.*		1st NM report
Zerene cesonia (Stoll, 1790)	Colias Caesonia *Stoll*		1st NM report
Phoebis sennae (Linnaeus, 1758)			
ssp. *eubule* (Linnaeus, 1767)	Callidryas Eubule *L.*		1st NM report
Eurema mexicana (Boisduval, 1836)	Terias Mexicana *Bd.*		1st NM report
Eurema nicippe (Cramer, 1779)	Terias Nicippe *Cram.*		1st NM report
Nathalis iole Boisduval, 1836	Nathalis Iole *Bd.*		1st NM report
Hypaurotis crysalus (W. H. Edwards)	Thecla Crysalus *Edw.*		1st NM report
Brephidium exile (Boisduval, 1852)	not reported	1	1st NM specimen
Everes amyntula (Boisduval, 1852)	Lycaena Amyntula *Bd.*		1st NM report
Plebejus lupini (Boisduval, 1869)	Lycaena Acmon *West-Hew.*		1st NM report
Euptoieta claudia (Cramer, 1775)	Euptoieta Claudia *Cram.*		1st NM report
Chlosyne lacinia (Ceyer, 1837)			
ssp. *crocale* (W. H. Edwards, 1874)	Synchloe Crocale *Edw.*		1st NM report
Phyciodes pictus (W. H. Edwards, 1865)	Phyciodes picta *Edw.*		1st NM report
Polygonia gracilis Grote and Robinson, 1867			
ssp. *zephyrus* (W. H. Edwards, 1870)	Crapta Zephyrus *Edw.*	1	1st NM specimen
Nymphalis milberti (Codart, 1819)	Vanessa Milberti *Godt.*		1st NM report
Vanessa virginiensis (Drury, 1773)	Pyrameis Huntera *Drury*		1st NM report
Vanessa cardui (Linnaeus, 1758)	Pyrameis cardui *L.*		1st NM report
Limenitis weidemeyerii (W.H. Edwards, 1861)	Limenitis Weidemeyerii *Edw.*		1st NM report
Adelpha bredowii Ceyer, 1837	Heterochroa Californica *But.*	1	1st NM specimen
Cyllopsis pertepida (Dyar, 1912)	Neonympha Henshawii *Edw.*	2	1st NM specimens
Cercyonis meadii (W. H. Edwards, 1872)	Satyrus Meadii *Edw.*		1st NM report
Danaus plexippus (Linnaeus, 1758)	Danais Archippus *Fab.*		1st NM report
Danaus gilippus (Cramer, 1775)	Danais Berenice *Cram.*		1st NM report

[1] SEM = Snow Entomological Museum at the University of Kansas.

the canyon rather than the whole area sampled, as it did for Santa Fe Canyon in 1880. Water Canyon crosses the 5000-foot contour in open desert grassland, but Snow camped two miles above the canyon mouth at about 8000 feet elevation. In addition to SEM specimens from this expedition, the American Museum of Natural History (AMNH) appears to have three specimens of *Cyllopsis pertepida* (Dyar), cited by Miller (1974:72).

1882: Gallinas Canyon, Sangre de Cristo Mountains

In 1882 Snow traveled to Gallinas Canyon, which begins in the southern portion of the Sangre de Cristo Mountains and descends southeastward through Las Vegas, in San Miguel County (Fig. 1). Arrival of the railroad in 1879 changed Las Vegas from a quiet farming village to a busy railroad town. Construction of a resort hotel near the hot springs in 1880 quickly made Las Vegas an international destination for consumptives and other health seekers.

The 1882 group, consisting of Snow, his family and three university students: Mr. Dyche, Mary Dyche, and Mr. W. W. Russ, produced more butterfly records than Snow's other New Mexico adventures. In Gallinas Canyon, Snow found a "naturalist's paradise" compared to the 1880 expedition and a safe haven compared to the expedition of 1881. "The occupancy of the mouth of the cañon by hotels and bathing-houses of that famous sanitarium, has proved an effectual barrier against the entrance of troublesome ruminants, and the entomologist and botanist is able to obtain the choicest of his favorite objects of study in delightful variety and perfection" (Snow 1883:35).

After nine weeks of collecting, Snow (1883) reported about 50 butterfly taxa (Table 3). From this expedition, the SEM retains 30 specimens representing

27 species, including three not given in Snow's report. Most specimens bear typeset labels stating: "Near Hot Springs, Las Vegas, N.M., 7000 ft., July, '82, F. H. Snow." Others give the date of collection as "Aug. '82." Two reported species, *Pieris sisymbrii* (Boisduval) and *Anthocharis sara* Lucas, fly only in spring; an SEM specimen of the former has "April" inked in longhand over the typeset "July." Archival materials suggest that Snow had an associate in Las Vegas who could have obtained these specimens in the proper season.

Once again, Snow's party explored a range of elevations not reflected on the specimen labels. Collecting at about 6800 feet elevation in foothill canyons near the Hot Springs probably produced Upper Sonoran Zone species like *Amblyscirtes aenus* W. H. Edwards. Gallinas Creek and its tributaries continue upstream from there, climbing gradually for more than 20 miles through Transition Zone into Canadian Zone habitats. Snow's group likely traveled this route, visiting elevations near 10,000 feet elevation to collect *Speyeria mormonia* Boisduval, *Oeneis chryxus* (Doubleday & Hewitson) and *Erebia epipsodea* Butler.

There are a few mismatches between SEM specimens and Snow (1883) reports (Table 3), primarily among the Hesperiidae. Snow reported *Thorybes bathyllus* (J. E. Smith), but the SEM specimen so labeled is actually *T. pylades* (Scudder). There also is confusion among the *Erynnis* spp., which were not well known at the time. An SEM specimen of *E. horatius* (Scudder & Burgess) is mislabeled as *E. martialis* (Scudder), yet neither can be linked conclusively to the reported *E. juvenalis* (Fabricius), which is erroneous. Among the SEM specimens labeled to the 1882 expedition are three that Snow (1883) did not report (Table 3).

Snow collected the type series of *Hesperia viridis* (W. H. Edwards) in 1882 during a period when skippers once lumped with Old World *Hesperia comma* (Linnaeus) were being differentiated and described. Amid this taxonomic instability, Snow (1883) reported collecting "*Pamphila Comma* n. var." Edwards (1883) described the male "sent me by Prof. Snow and taken by him at Los Vegas [sic], N. M., in 1882" and called it "var. *Viridis*." This was the only new taxon described using butterflies collected in New Mexico by Snow.

Two specimens found by F. M. Brown in the AMNH in the 1970s may be traceable to the 1882 expedition. A single specimen of *Euphyes vestris* (Boisduval) appears to have the distinctive Snow label for that expedition (Toliver et al. 1994:112). A specimen of *Hemiargus ceraunus* (Fabricius) is similarly labeled, but is dated "Sept." (Toliver et al. 1994:258). Each has a label indicating that it came to the AMNH via the Hulst collection.

1883: Gallinas Canyon, Sangre de Cristo Mountains

The butterfly collections of the 1883 expedition remain a mystery. Snow (1885) stated that in "July and August, 1883, our collections were made in the same locality as 1882—the Gallinas cañon, near the Las Vegas Hot Springs. My assistants were Messrs. L. L. Dyche, W. H. Brown, W. C. Stevens, and [my son] W. A. Snow." Lists of Lepidoptera and Coleoptera published for this trip included only those species that were not reported from 1882 (Snow 1885). Apparently no butterflies satisfied this criterion because none were listed among the many beetles and moths. Similarly, the SEM contains no butterfly specimens with labels traceable to this expedition. Snow's decision to neither report duplicates nor retain them in the collection would have been consistent with his normal practice.

1884: Walnut Canyon and Elk Mountain

The 1884 expedition included the same people as in 1883, but this time they split into two groups and produced butterflies from two geographically and ecologically distinct localities. Dyche and Brown detrained at Las Vegas and returned to the site of their successful 1882 and 1883 campaigns. Prof. Snow, his son Willie and W. C. Stevens traveled to Silver City in the southwest corner of New Mexico (Fig. 1). As far as we have been able to ascertain, and in contrast to previous expeditions, the 1884 butterfly specimens are not labeled to indicate month, year and locality of capture. Perhaps material from the two parties became mixed at some point, placing in doubt the provenance of individual specimens. Because Snow returned with butterflies unique to southwestern New Mexico and reported them (Snow 1885), the authors were able to propose below a consistent labeling scheme for the 1884 specimens.

Little Walnut Creek. Snow "encamped about twelve miles north of Silver City, on the Walnut Creek, some three miles west of the divide which separates the Atlantic and Pacific slopes" (Snow 1885:65) (Fig. 1). This coincides today with the Gila National Forest's Little Walnut Creek Picnic Ground, at about 6500 feet elevation in the Pinos Altos Mountains.

Snow's entire report for 1884 listed just 13 species of butterflies, all from Little Walnut Creek (Table 4a). His list was short considering that the area supports well over 100 species (e.g., Hubbard 1965, Ferris 1976, Zimmerman 2001) and that summer rains usually make August a productive month. Snow (1885:69) explained that "the season was a very dry one, there being hardly enough rain, except on one occasion, to thoroughly wet the canvas of our tent in the Walnut

TABLE 3. Butterflies collected during Snow's 1882 expedition to Gallinas Canyon, San Miguel County, NM.

Taxon	Reported by Snow (1883) as	Number of SEM[1] specimens	Importance
Thirybes pylades (Scudder, 1870)	Eudamus Pylades *Scud.*	1[2]	1st NM specimen
Erynnis horatius (Scudder & Burgess, 1870)	not reported	1[3]	1st NM specimen
Erynnis pacuvius	Thanaos juvenalis *F.*[4]		
	Thanaos Pacuvinus *Lintn.*		
Pyrgus communis (Grote, 1872)	Pyrgus tesselatta *Scud.*		1st NM report
Oarisma edwardsii (Barnes, 1897)	not reported	1[5]	1st NM specimen
Oarisma garita (Reakirt, 1866)	Thymelicus Hylax *Edw.*	1	1st NM specimen
Hesperis comma (Linnaeus, 1758)	Pamphila Comma var. Juba *Scud.*[6]		
Hesperia viridis (W. H. Edwards, 1883)	Pamphila Comma n. var.		
Polites themistocles (Latreille, 1824)	Pamphila Cernes *Bd.-Lec.*	1	1st NM specimen
Poanes taxiles (W. H. Edwards, 1881)	Pamphila Taxiles *Edw.*[7]	2	1st NM specimens
Paratrytone snowi (W. H. Edwards, 1877)	Pamphila Snowi *Edw.*		1st NM report
Euphyes vestris (Boisduval, 1852)	Pamphila Metacomet *Harr.*[8]		1st NM report
Amblyscirtes aenus W. H. Edwards, 1878	Amblyscirtes aeneus *Edw.*		1st NM report
Amblyscirtes cassus W. H. Edwards, 1883	not reported	1	1st NM specimen
Amblyscirtes phylace (W. H. Edwards, 1878)	Pamphila Phylace *Edw.*	2	1st NM specimens
Pterourus multicaudatus (W. F. Kirby, 1884)	Papilio Daunus *Edw.*	1	
Pterourus rutulus (Lucas, 1852)	Papilio Rutulus *Bd.*	1	
Neophasia menapia (C. and R. Felder, 1859)	Pieris Menapia *Feld.*		1st NM report
Pontia sisymbrii (Boisduval, 1852)	Pieris Sisymbri *Bd.*	1	1st NM specimen
Pontia occidentalis (Reakirt, 1866)	Pieris occidentalis *Reak.*		1st NM report
Pieris napi (Linnaeus, 1758)	Pieris oleracea *Bd.*[9]	1	1st NM specimen
Anthocharis thoosa (Scudder, 1878)	Anthocaris Thoosa *Scud.*	1	1st NM specimen
Euchloe ausonides (Lucas, 1852)	Anthocaris Ausonides *Bd.*	1	1st NM specimen
Colias eurytheme Boisduval, 1852	Colias Eurytheme *Bd.*		1st NM report
Zerene cesonia (Stoll, 1790)	Colias Caesonia *Stoll.*		
Nathalis iole Boisduval, 1836	Nathalis Iole *Bd.*		
Lycaena arota (Boisduval, 1852)	Chrysophanus Ianthe *Edw.*	1	1st NM specimen
Lycaena helloides (Boisduval, 1852)	Chrysophanus helloides *Bd.*	1	1st NM specimen
Hypaurotis crysalus (W. H. Edwards, 1873)	Thecla Crysalus *Edw.*		
Satyrium calanus (Hübner, 1809)	Thecla Calanus *Hubn.*	2	1st NM specimens
Satyrium behrii (W. H. Edwards, 1870)	Thecla Behrii *Edw.*		1st NM report
Callophrys affinis (W. H. Edwards, 1862)	Thecla Apama *Edw.*	1	1st NM specimen
Mitoura grynea (Hübner, 1819)			
ssp. *siva* (W. H. Edwards, 1874)	Thecla Siva *Edw.*	1	
Incisalia eryphon (Boisduval, 1852)	Thecla Eryphon *Bd.*	1	1st NM specimen
Leptotes marina (Reakirt, 1868)	Lycaena marina *Reak.*		1st NM report
Everes amyntula (Boisduval, 1852)	Lycaena Amyntula *Bd.*		
Glaucopsyche lygdamus (Doubleday, 1841)			
ssp. *oro* (Scudder, 1876)	Lycaena Lygdamus var. Oro *Scud.*		1st NM report
Lycaeides melissa (W. H. Edwards, 1873)	Lycaena Melissa *Edw.*		1st NM report
Icaricia lupini (Boisduval, 1869)	Lycaena Acmon *West-Hew.*		
Agriades franklinii (Curtis, 1835)	Lycaena orbitulus *Von Pr.*	1	1st NM specimen
Apodemia nais (W. H. Edwards, 1876)	Nemeobius Nais *Edw.*	1	
Euptoieta claudia (Cramer, 1775)	Euptoieta Claudia *Cram.*	1	
Speyeria aphrodite (Fabricius, 1787)			
ssp. *ethne* (Hemming, 1933)	Argynnis Alcestis *Edw.*	1	1st NM specimen
Speyeria hesperis (W. H. Edwards, 1864)			
ssp. *electa* (W. H. Edwards, 1878)	Argynnis Electa *Edw.*		
Speyeria mormonia (Boisduval, 1869)			
ssp. *eurynome* (W. H. Edwards, 1872)	Argynnis Eurynome *Edw.*	1	1st NM specimen
Poladryas minuta (W. H. Edwards, 1861)	Melitaea minuta *Edw.*		1st NM report
Thessalia fulvia (W. H. Edwards, 1879)	Melitaea Fulvia *Edw.*	1	1st NM specimen
Chlosyne nycteis (Doubleday and Hewitson, 1847)	Phyciodes Nycteis var.		1st NM report
Phyciodes cocyta (Cramer, 1777)	Phyciodes Tharos n. var.[10]		1st NM report
Phyciodes pratensis (Behr, 1863)			
ssp. *camillus* W. H. Edwards, 1871	Phyciodes Camillus *Edw.*		1st NM report
Euphydryas anicia (Doubleday and Hewitson 1848)	Melitaea Nubigena *Behr*		1st NM report
Polygonia gracilis (Grote and Robinson, 1867)			
ssp. *zephyrus* (W. H. Edwards, 1870)	Grapta Zephyrus *Edw.*		

TABLE 3. Continued.

Taxon	Reported by Snow (1883) as	Number of SEM[1] specimens	Importance
Nymphalis milberti (Godart, 1819)	Vanessa Milberti *Godt.*		
Nymphalis antiopa (Linnaeus, 1758)	Vanessa Antiopa *L.*		1st NM report
Nymphalis californica (Boisduval, 1852)	Vanessa Californica *Bd.*	1	1st NM specimen
Vanessa virginiensis (Drury, 1773)	Pyrameis Huntera *Drury*		
Vanessa cardui (Linnaeus, 1758)	Pyrameis cardui *L.*		
Limeitis weidemeyerii (W. H. Edwards, 1861)	Limenitis Weidemeyerii *Edw.*		
Cyllopsis pertepida (Dyar, 1912)	Neonympha Henshawii *Edw.*		
Coenonympha ochracea W. H. Edwards	Coenonympha ochracea *Edw.*		1st NM report
Cercyonis pegala (Fabricius, 1775)	Satyrus Nephele *Kirby*		1st NM report
Cercyonis oetus (Boisduval, 1869) ssp. *charon* (W. H. Edwards, 1872)	Satyrus Charon *Edw.*		1st NM report
Erebia epipsodea Butler, 1868	Erebia epipsodea *Butler*		1st NM report
Neominois ridingsii (W. H. Edwards, 1865)	Hipparchia Ridingsii *Edw.*		1st NM report
Oeneis chryxus (Doubleday and Hewitson, 1849)	Chionobas Uhleri *Reak.*		1st NM report
Danaus plexippus (Linnaeus, 1758)	Danais Archippus *Fab.*		
Danaus gilippus (Cramer, 1775)	Danais Berenice *Cram.*		

[1] SEM = Snow Entomological Museum at the University of Kansas.
[2] Snow also reported "Eudamus Bathyllus *Sm.-Abb.*" This specimen of *T. pylades* has an old label misidentifying it as *T. bathyllus*.
[3] An old label misidentifies this specimen as *E. martialis* (Scudder), which Snow (1883) did not report.
[4] *E. juvenalis* does not occur in New Mexico; without a specimen, there is no way to know to what Snow referred.
[5] An old label misidentifies this specimen as *O. garita*.
[6] Although no specimen was found, this was likely a routine *H. comma* rather than a range-extending *H. juba* (Scudder).
[7] Snow also reported "Poanes Zabulon *Bd.-Lec.*" which does not occur in New Mexico.
[8] Snow also reported "Pamphila bimacula *Gr.-Rob.*" which does not occur in New Mexico.
[9] Snow also reported "Pieris Napi var. pallida *Scud.*," which was synonymized.
[10] Snow also reported "Phyciodes tharos var. Marcia *Edw.*," which refers to the same species.

creek cañon during a stay of five weeks. The bed of the creek was dry for long distances." Eight of the 13 species reported by Snow (1885) were found in the SEM collection, each pinned to a label tersely typeset in black ink stating merely "New Mexico. F. H. Snow."

In 2002, the SEM had 15 additional specimens with "New Mexico. F. H. Snow." labels, which Snow (1885) did not report. Habitat preferences and geographic distributions (e.g., Cary & Holland 1994, Toliver et al. 1994) suggest that Little Walnut Creek was the only one of Snow's New Mexico destinations capable of producing several species bearing the "New Mexico" labels (Table 4b). These additional 11 species bring the 1884 Little Walnut Creek catch to 24 species. To that it seems reasonable to add a small series of *Cyllopsis pertepida* specimens in the AMNH with like "New Mexico" labels (Miller 1974:72). Together, these specimens support a common origin for the "New Mexico. F. H. Snow." labels.

Among the final tally for Snow's Little Walnut Creek party were three new species: *Atrytonopsis lunus* (W. H. Edwards), *Piruna polingii* (Barnes) and *Erynnis meridianus* Bell, which were described in 1884, 1900 and 1927, respectively (Miller & Brown 1981). The biggest surprise was *Eurema salome* (C. Felder & R. Felder), a subtropical stray for which Snow's specimen remains the only New Mexico record. This specimen was attributed to New Mexico by Ehrlich and Ehrlich (1961:64) but without substantiating data, leaving recent workers skeptical (e.g., Scott 1986:207, Toliver et al. 1994:203). The specimen in question was in the SEM in 2002 pinned to a "New Mexico. F. H. Snow." label and to a second label stating it was "illustrated in Ehrlich's 'How to Know the Butterflies'."

Elk Mountain. Gallinas Canyon was the starting point for the other section of the 1884 expedition, which apparently did no collecting there. Dyche explained that his party "collected part of the summer at Harvey's ranch, on top of 'Baldy' mountain, about twenty-five miles northwest of Las Vegas" (Dyche 1909:43). The Harvey property is at 9500 feet elevation near the head of Cascade Canyon, a tributary to Gallinas Creek (U.S. Forest Service 1994). From there, Elk Mountain was a brief six-mile horseback ride to the west. At 11,700 feet elevation, Elk Mountain is the nearest peak sufficiently treeless to qualify as "bald." Dyche and Brown traveled on, spending "about six weeks of our time thirty to forty miles to the northwest of Harvey's ranch, on the head waters of the Pecos river" (Dyche 1909:43). There is no suggestion that they reached the highest peaks, which exceed 13,000 feet elevation.

TABLE 4A. Butterflies collected during Snow's 1884 expedition to Little Walnut Creek as reported by Snow (1885).

Taxon	Reported by Snow (1885) as	Number of SEM[1] specimens	Importance
Autochton cellus (Boisduval and Leconte, 1837)	*Eudamus cellus* Bd.-Lec.		1st NM report
Cogia caicus (Herrich-Schäffer, 1869) ssp. *moschus* (W. H. Edwards, 1882)	*Eudamus moschus* Edw.	1	1st NM specimen
Erynnis pacuvius (Lintner, 1876)	*Thanaos pacuvius* Lintn.		
Piruna polingii (Barnes, 1900)	*Pholisora*, n. sp.	1	1st NM specimen
Amblyscirtes aenus W. H. Edwards, 1878	*Amblyscirtes aenus* Edw.		
Atrytonopsis lunus (W. H. Edwards, 1884)	*Pamphila lunus* Edw.	1	1st NM specimen
Battus philenor (Linnaeus, 1771)	*Papilio philenor* L.	1	1st NM specimen
Atlides halesus (Cramer, 1777)	*Thecla halesus* Cram.		1st NM report
Erora quaderna (Hewitson, 1868)	*Thecla laeta* Edw.	1	1st NM specimen
Leptotes marina (Reakirt, 1868)	*Lycaena marina* Edw.	1	
Hemiargus isola (Reakirt, 1866)	*Lycaena alce* Edw.	1	1st NM specimen
Celastrina ladon (Cramer, 1780)	*Lycaena neglecta* Edw.	1	1st NM specimen
Limenitis arthemis (Drury, 1773) ssp. *arizonensis* (W. H. Edwards, 1882)	*Limenitis ursula* Fab. var. *Arizonensis* Edw.		1st NM report

[1] SEM = Snow Entomological Museum at the University of Kansas.

The expedition report (Snow 1885) listed no butterflies collected by this party, but we believe a few butterflies captured by Dyche and Brown reside in the SEM collection, linked to the 1884 expedition by vague "New Mexico. F. H. Snow." labels (Table 4c). Their habitat requirements associate them with the Canadian Zone west of Las Vegas, rather than the Upper Sonoran and Transition Zone habitats of Little Walnut Creek. Some of these species also were caught by the 1882 expedition (Table 3).

The "New Mexico. F. H. Snow." labels may always be somewhat problematic. One could argue that certain individual specimens with that label match up with published reports from 1881 or 1882. But it seems unlikely that the careful Snow would attach vague labels to one specimen in lieu of the informative labels pinned to the other specimens from that expedition. Seeking parsimony for the "New Mexico. F. H. Snow." labels, we suggest that they were printed for and affixed to one lot of specimens. 1884 was the only year that could have produced all those specimens and no specimens from 1884 are otherwise labeled.

What might have prompted Snow to attach such general labels to this lot? Snow was a notoriously hard worker who accepted all challenges, leaving less time for his collections (Dyche 1909:43). In the early 1880s Snow taught botany, zoology, geology, natural history, meteorology and comparative anatomy—a burden of classes "which ought to have been taught by four men" (Hyder 1953:143). He also helped Kansas farmers deal with insect pests. Snow led no expeditions from 1885 to 1889, but continued adding teaching duties until he was physically and mentally exhausted (Hyder 1953:143). If Snow's 1884 expedition concluded as such expeditions became low priority, there may have been adverse consequences for specimen management and labeling.

One remaining puzzle is *Poanes zabulon*, which Snow (1883) reported from his 1882 expedition (see

TABLE 4B. Butterflies attributable to Snow's 1884 expedition to Little Walnut Creek, but not reported by Snow (1885).

Taxon	Number of SEM specimens	Importance
Erynnis meridianus Bell, 1927	1	1st NM specimen
Erynnis afranius (Lintner, 1878)	1	
Poanes taxiles (W. H. Edwards, 1881)	1	
Euphyes vestris (Boisduval, 1852)	1	
Amblyscirtes nereus (W. H. Edwards, 1876)	1	1st NM specimen
Eurema mexicana (Boisduval, 1836)	1	
Eurema salome (C. and R. Felder, 1861)	1	1st NM specimen
Eurema nicippe (Cramer, 1779)	1	
Plebejus lupini (Boisduval, 1869)	2	1st NM specimens
Thessalia theona (Ménétriés, 1855) ssp. *thekla* (W. H. Edwards, 1870)	1	1st NM specimen
Danaus gilippus (Cramer, 1775)	1	1st NM specimen

[1] SEM = Snow Entomological Museum at the University of Kansas.

TABLE 4C. Butterflies collected by the Dyche party of Snow's 1884 expedition, but not reported by Snow (1885).

Taxon	Number of SEM[1] specimens	Importance
Polites origenes (Fabricius, 1793)	2	1st NM specimens
Colias scudderi (Reakirt, 1865)	1	1st NM specimen
Erebia epipsodea (Butler, 1868)	2	
Oeneis chryxus (Doubleday and Hewitson, 1849)	1	
Oeneis uhleri (Reakirt, 1866)	1	1st NM specimen

[1] SEM = Snow Entomological Museum at the University of Kansas.

Table 3). In 1978 Toliver located a specimen in the SEM and found it correctly determined, but its "New Mexico. F. H. Snow." label links it to the 1884 expedition. More worrisome, however, is that *P. zabulon* does not occur west of the Great Plains (e.g., Ferris & Brown 1980:104, Scott 1986:452). *Poanes zabulon* breeds in the vicinity of KU and the SEM has many specimens of local provenance. Snow's New Mexico specimen likely is mislabeled and the report in error; this may be the exception that shows what a careful scientist Snow was.

1894: Hop Canyon, Magdalena Mountains

After a 10-year absence from New Mexico, Snow returned to the Magdalena Mountains in early August 1894 with his son Frank, Ermine Case, Hugo Kahl and an unnamed student (Hyder 1953:280). They made camp in Hop Canyon, which is on the northwest flank of the Magdalena Mountains and descends through the town of Magdalena (Fig. 1). Snow's camp may have been near the then-active lead mining camp of Kelly, about 30 air miles southwest of Socorro and 10 air miles west of his Water Canyon camp of 1881, and the terminus of the local railroad at that time.

Compared to that abbreviated effort 13 years earlier, this expedition went more smoothly. A fragment of a letter from Hop Canyon, dated 3 August 1894, was transcribed by one of Snow's daughters many years later: "I think I was never so completely cut off from the world as here in this beautiful canyon . . . We have had no interruption of our successful entomological campaign except on Sunday and today. The latter interruption was in consequence of a great storm which came upon us last night . . . . The dry bed of the canyon became an immense torrent in five minutes' time and we were somewhat afraid that the flood would reach our tents, but we were high enough up to avoid that catastrophe . . . I have never had so efficient a team for collection of insects. Will and Mr. Kahl take first place and the rest of us are not far behind. We have averaged about 500 pinned insects per day . . ."

TABLE 5. Butterflies collected during Snow's 1894 expedition to Hop Canyon, Magdalena Mountains, Socorro County, New Mexico.

Taxon	Number of SEM[1] specimens	Importance
Erynnis pacuvius (Lintner)	1	
Celastrina ladon (Cramer, 1780)	2	
Lycaeides melissa (W. H. Edwards, 1873)	1	
Apodemia mormo (C. and R. Felder, 1859) ssp. *mejicana* (Behr, 1865)	1	1st NM specimen
Speyeria hesperis (W. H. Edwards, 1864) ssp. *dorothea* Moeck, 1947	1	1st NM speeimen
Polygonia gracilis (Grote and Robinson, 1867) ssp. *zephyrus* (W. H. Edwards, 1870)	1	
Nymphalis milberti (Godart, 1819)	2	
Vanessa virginiensis (Drury, 1773)	1	

[1] SEM = Snow Entomological Museum at the University of Kansas.

This expedition occurred while Snow was preoccupied as UK Chancellor and did not publish expedition results. Later, Snow (1907) published a comprehensive list of the Coleoptera collected on all six New Mexico expeditions including this one, but no 1894 Lepidoptera have been published previously.

The SEM contains nine examples of eight species from this expedition (Table 5). Most specimens have a typeset label stating "Magdalena Mts. N. M. Aug. '94. Snow." Others are labeled with "Magdalena, New Mexico." Neither label specifies elevation, but Magdalena is at 6600 feet and Kelly is at 7400 feet. Snow's practice in previous years suggests that locality labels are best interpreted as general descriptions of the area collected. Habitat associations suggest that Snow ventured to about 8000 feet elevation.

A few 1894 specimens are known from other institutional collections. A single specimen of *Mitoura grynea siva* (W. H. Edwards) was found by the senior author during review of collections at the NMNH ca. 1985. The name of Snow's expedition assistant, H. Kahl, appears on labels of two Carnegie Museum

(CM) specimens of *Mestra amymone* (Ménétriés) from the "Magdalena Mts. N. M. Aug. '94. Snow." (Toliver et al. 1994:387).

Discussion

Westward extension of the railroad opened the door for Snow's New Mexico expeditions. Snow was among the first entomologists to take advantage of 1000 miles of new track that penetrated and traversed New Mexico between 1879 and 1881 (Myrick 1990). With free passes donated by the Atchison, Topeka and Santa Fe Railroad (Hyder 1953:153), Snow probed the limits of railroad transportation in New Mexico in 1880, 1881, 1884 and 1894.

At the forefront of butterfly discovery in the American Southwest, Snow succeeded in finding butterflies new to science. *Lycaena cupreus snowi* (W. H. Edwards) and *Paratrytone snowi* (W. H. Edwards) were named in his honor after he discovered them in Colorado in the late 1870s (Snow 1879, 1881a). He collected examples of several species in New Mexico before they were formally described but, despite sending specimens to prominent scientists, most of Snow's New Mexico material was not used to describe new species. Only *Hesperia viridis* was described based on specimens collected by Snow in New Mexico (Edwards 1883). He also collected several taxa concurrent with, or shortly after, publication of formal descriptions.

Most of Snow's extant New Mexico butterfly specimens were located in the SEM, whose modest holdings of North American butterflies made the search for 80 Snow specimens reasonably profitable. In contrast, the few isolated specimens known from other institutional collections were encountered largely by accident. Collections at the NMNH, CM and AMNH are much larger and the numbers of Snow butterflies much smaller. The NMNH has records of receiving many of Snow's Orthoptera, but no such records for butterflies (Marc Epstein, pers. com., February 2002).

Workers in beetles and moths may find treasures among Snow's material. In his New Mexico expedition reports, Snow's lists of beetles and moths dwarfed those of butterflies. His role in the discovery and description of *Daritis howardi* (Hy. Edwards) (Arctiidae: Pericopinae) was documented elsewhere (Cary 2002). Snow collected beetles and moths at more places than he did butterflies, including Albuquerque and Socorro (Snow 1883, 1907). Rather than sit idle during evening stopovers in those towns, it would have been characteristic of Snow to find city lights or build large fires around which to collect beetles and moths all night. Some butterfly specimens eventually may turn up from these locations.

Snow's collections were the first substantive effort to document New Mexico butterflies. He recorded approximately 90 species—still the largest single contribution to knowledge of the New Mexico fauna. Some of these probably were collected in New Mexico previously, but most earlier reports lack meaningful documentation and, except for a few types, are anecdotal and lack scientific value. Snow set a new standard by publishing his results and describing collectors, identifiers, locations and dates. He left dozens of specimens pinned with labels containing information still useful today. Subsequent New Mexico butterfly study would be based on this foundation.

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Confusion persists regarding publication dates for the Transactions of the Kansas Academy of Science (TKAS). They were published every two years, so that manuscripts submitted in 1877 and 1878 were published in 1878 as Volume VI. One partial bibliography (Marvin 1909) confused the matter, giving dates for both even and odd years. Hyder (1953:269–273) dodged the issue by indicating the TKAS volume, but not the year of publication. We tried to give correct dates below, but in case of confusion the reader should put more faith in the volume enumerated than the year of publication.

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